DEPARTMENT OF TRANSPORTATION
DIVISION OF ENGINEERING SERVICES
OFFICE ENGINEER
1727 30th Street MS-43
P.O. BOX 168041
SACRAMENTO, CA 95816-8041
FAX (916) 227-6214
www.dot.ca.gov/hq/esc/oe

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July 8, 2016

08-Riv-79-R33.9
08-1E1004
Project ID 0813000152
ACHSSTBG-P079(040)E

Addendum No. 1

Dear Contractor:

This addendum is being issued to the contract for CONSTRUCTION ON STATE HIGHWAY IN RIVERSIDE COUNTY NEAR SAN JACINTO AT GILMAN SPRINGS ROAD to revise the project plans, the *Notice to Bidders and Special Provisions and the Information Handout.*

Submit bids for this work with the understanding and full consideration of this addendum. The revisions declared in this addendum are an essential part of the contract.

Bids for this work will be opened on Tuesday, July 19, 2016.

Project plan sheets 13, 33, 34, 35, 36, and 40 are replaced and attached for substitution for the like-numbered sheets.

In the Special Provisions, Section 2, 2-1.06B is replaced as attached.

In the Special Provisions, Section 6-2.03, the first paragraph is replaced as follows:

"The Department furnishes you with:

- Model 2070L controller assembly, including controller unit, completely wired controller cabinet, global positioning system (GPS) and detector sensor units.
- Components of battery backup system as follows:
  - Inverter/charger unit
  - Power transfer relay
  - Manually-operated bypass switch
  - Battery harness
  - Utility interconnect wires
  - Battery temperature probe
  - Relay contact wires."

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In the Special Provisions, Section 77 is added as attached.

In the Special Provisions, Section 86-1 and 86-2 are replaced as attached.

In the Special Provisions, Section 90 is added as attached.

The *Information Handout* is replaced as attached.

To *Bid* book holders:

Inquiries or questions in regard to this addendum must be communicated as a bidder inquiry and must be made as noted in the *Notice to Bidders* section of the *Notice to Bidders and Special Provisions*.

Submit the *Bid* book as described in the *Electronic Bidding Guide* at the Bidders' Exchange website.

http://www.dot.ca.gov/hq/esc/oe/electronic_bidding/electronic_bidding.html

Inform subcontractors and suppliers as necessary.

This addendum, EBS addendum file and attachments are available for the Contractors' download on the Web site:

http://www.dot.ca.gov/hq/esc/oe/project_ads_addenda/08/08-1E1004

If you are not a *Bid* book holder, but request a book to bid on this project, you must comply with the requirements of this letter before submitting your bid.

Sincerely,

JOHN BULINSKI
District Director

Attachments

Add between the 1st and 2nd paragraphs of section 2-1.06B:

The Department makes the following supplemental project information available:

Supplemental Project Information

Means	Description
Included in the *Information Handout*	1. California Department of Fish and Game Streambed Alteration Agreement Section 1602 Permit. 2. Water Resource Information.
Available as specified in the *Standard Specifications*	Cross Sections
Available electronically at the Contract Plans and Special Provisions link at the Office Engineer-All Projects Currently Advertised web site[a]	Original ground data in "3D DGN" format Original ground data in "XML" format Design horizontal alignment in "XML" format Design horizontal alignment in "TXT" format Cross Sections Read Me File.pdf Group 1 Cross Sections.pdf Group 2 Cross Sections.pdf Group 3 Cross Sections.pdf Group 4 Cross Sections.pdf

[a]http://www.dot.ca.gov/hq/esc/oe/weekly_ads/all_adv_projects.php

Add section to section 77:

77-4 EMERGENCY VEHICLE DETECTION SYSTEM

77-4.01 GENERAL

77-4.01A Summary

Section 77-4 includes specifications for constructing emergency vehicle detection systems.

77-4.02 MATERIALS

77-4.02D(3) Detector Cables

The cable must have 3 LDPE insulated conductors no. 20 stranded tinned copper. The conductors' minimum insulation thickness must be 25 mils and color coded: 1 yellow, 1 blue, and 1 orange.

The cable shield must be either tinned copper braid or aluminized polyester film with a nominal 20 percent overlap. Where film is used, a no. 20 stranded tinned bare drain wire must be provided.

The cable jacket must be rated 600 V(ac) and 80 degrees C and be black PVC with a minimum thickness of 43 mils.

The outside diameter of the cable must not exceed 0.35 inch.

The capacitance between any conductor and the other conductors and the shield must not exceed 48 pF per foot at 1,000 Hz.

77-4.03 CONSTRUCTION

Install cables between each optical detector and the controller cabinet. Do not splice the cable. Terminate the cable under the manufacturer's instructions.

77-4.04 PAYMENT

Not Used

Replace the 1st sentence in the 15th paragraph of section 86-1.02P(2) of the RSS for section 86 with:

The interior of the enclosure must accept plug-in cable circuit breakers. The circuit breakers must be mounted on non-energized clips and vertically with the up position of the handle being the "ON" position.

Add to the list in the 2nd paragraph of section 86-1.02R(4) of the RSS for section 86:

4. Be made of metal.

Add to the beginning of section 86-2.01C(2)(c)(i) of the RSS for section 86:

Use Type 3 Schedule 80 conduit for underground installation.

Replace the 3rd paragraph of section 86-2.01C(3)(a) of the RSS for section 86 with:

Install a pull box on a bed of crushed rock.

Replace the 1st paragraph of section 86-2.01C(6)(b)(ii) of the RSS for section 86 with:

Install a Type B loop detector lead-in cable in conduit.

Replace the 1st paragraph of section 86-2.01C(6)(c)(ii) of the RSS for section 86 with:

Use a Type 2 loop wire. Use only Type 2 loop wire for Type E loop detectors.

Delete the 3rd paragraph of section 86-2.01C(7) of the RSS for section 86.

Replace the 2nd paragraph of section 86-2.01C(8)(b) of the RSS for section 86 with:

Use "Method B" to insulate a splice.

Add to the beginning of section 86-2.01C(10)(b) of the RSS for section 86:

The sign mounting hardware must be installed at the locations shown.

Install non-illuminated street name signs on signal mast arms using a minimum 3/4-by-0.020-inch round-edge stainless steel strap and saddle bracket. Wrap the strap at least twice around the mast arm, tighten, and secure with a 3/4-inch stainless strap seal. Level the sign panel and tighten the hardware securely.

Set the Type 1 standards with the handhole on the downstream side of the pole in relation to traffic or as shown.

Add between the 11th and 12th paragraphs of section 86-2.01C(22)(b) of the RSS for section 86:

Use hot-melt rubberized sealant to fill slots.

Replace the paragraphs in section 86-2.04C(2) of the RSS for section 86 with:

Deliver the battery backup system cabinet to the Department's maintenance electrical shop at:

District 8 Warehouse
Region Maintenance MS9
Cluster Street
Bernardino, CA 92408

North
175 West
San

The Department assembles the battery backup system.

The Department notifies you when the assembled Model 332L cabinet with battery backup system cabinet is ready for you to pick up.

Install the assembled cabinet on the foundation.

Replace "Reserved" in section 86-2.08 of the RSS for section 86 with:

86-2.08 LONG TERM EVOLUTION (LTE) ASSEMBLY

86-2.08A General

86-2.08A(1) Summary

Use section 86-2.08 for long term evolution (LTE) wireless modem assembly installations.

LTE is a standard for wireless data communications technology and an evolution of the GSM/UMTS standards. The goal of LTE is to increase the capacity and speed of wireless data networks using new digital signal processing and modulations.

86-2.08A(2) Abbreviation

DHCP: Dynamic Host Configuration Protocol

DPS: Global Positioning System

DSP: Digital Signal Processing

EDGE: Enhanced Data Rate for GSM Evolution

ESD: Electrostatic Discharge

EV-DO: Evolution-Data Optimized

EVDO: Evolution Data Only

FCC: Federal Communications Commission

GPRS: General Packet Radio Services

GRE: Generic Routing Encapsulation

GSM: Global System for Mobile Communications

HSPA: High-Speed Packet Access

HSUPA: High-Speed Uplink Packet Access

HSDPA: High-Speed Downlink Packet Access

HTTP: Hypertext Transfer Protocol

HTTPS: Hypertext Transfer Protocol Secure

IEC: International Electro technical Commission

IEEE: Institute of Electrical Electronics Engineers

IP: Ingress Protection

IP64: Protected from total dust ingress

MAC address: Media Access Control address

MAP: Mobile Application Part

MIMO: Multiple Input, Multiple Output

NEMA: National Electrical Manufacturers Associations

RF: Radio Frequency

ROHS: Restriction of Hazardous Substances Directive

RS: Rapid Share

SCTP: Stream Control Transmission Protocol

SMA: SubMiniature Version A connector

SMS: Short Message Service

SMTP: Simple Mail Transfer Protocol

SNMP: Simple Network Management Protocol

SSH: Secure Shell tunneling

TAIP: Trimble ASCII Interface Protocol

TCP: Transmission Control Protocol

TSIP: Trimble Standard Interface Protocol

UDP/IP: User Datagram Protocol / Internet Protocol

UMTS: Universal Mobile Telecommunications System

USB: Universal Serial Bus

VPN: Virtual Private Network

86-2.08A(3) Submittals

Submit warranty documentation as an informational submittal before installation.

86-2.08A(4) Quality Control and Assurance

86-2.08A(4)(a) Acceptance testing

At the time of the traffic signal turn-on, the LTE assembly will be tested by State forces by performing a loop back test at the installation site. The test will be for a period of not less than 5 days of continuous, satisfactory operation

86-2.08A(4)(b) Warranty

Furnish a 2-year replacement warranty from the manufacturer of the modem and power supply against any defects or failures. The effective date of the warranty is the date of successful completion of acceptance testing. The manufacturer must furnish replacement modems and power supplies within 5 days after receipt of the failed parts. The Department does not pay for the replacement parts. Deliver replacement modems and power supplies to the following department maintenance electrical shop:

District 8 - Caltrans Electrical Maintenance Yard
175 West Cluster Street
San Bernardino, CA 92408

86-2.08B Materials

The LTE wireless modem assembly consists of a modem, power supply, mounting bracket, hardware, serial communication cable, and antenna.

86-2.08B(1) Modem

The modem must:

1. Weigh less than 2 lb and have overall dimensions of less than 8 by 4 by 2 inches. The housing must be constructed of anodized aluminum.

2. Have the following status indicators:

   2.1. Power on
   2.2. Channel acquired
   2.3. Link status
   2.4. Network registration
   2.5. Received signal strength indicator
   2.6. Transmit and receive data

3. Meet the operational parameters shown in the following table:

Frequency Band	Requirement
LTE	700 MHz
CDMA EVDO	800/1900 MHz

4. Have the following standard interfaces:

   4.1. TCP/IP, UDP/IP, DHCP, HTTP, SNMP, SMTP, SMS, Modbus, and Binary.
   4.2 Device manager software for configuration and access

5. Have the following hardware interfaces:
   5.1 SMA antenna connector (RF and LTE)
   5.2 Ethernet: 10/100 base-T RJ45 ethernet
   5.3 RS-232 serial port

The Contractor must provide the LTE modem to the Engineer a minimum of 10 days before the Contractor picks up the Type Model 332L cabinet.

The modem and associated firmware, software, hardware, protocol, and other features must be fully compatible with the existing Verizon wireless cellular network.

86-2.08B(2) Power Supply

The power supply must:

1. Have provisions to attach the modem power cable securely without modifying the cable.
2. Meet the requirements shown in the following table:

Characteristics	Requirements
Power cord	Standard 120 V(ac), 3 prong cord, at least 3 feet long
Operating temperature range	-22 to 158°F
Storage temperature	-40 to 185°F
Operating humidity range	5 to 95 percent non-condensing
Input voltage	10 to 28 V(dc)
Input current	40 to 200mA
Safety standards	UL 1012, UL 60950
Typical receive	200 mA at 12V(dc)
Typical transmit	Approximately 200 mA at 12V(dc)
Doormat connection (idle for 10-20 seconds)	40 mA at 12V(dc)

86-2.08B(2) Mounting Bracket and Hardware

The mounting bracket must:

1. Be stainless steel.
2. Securely hold the modem in a vertical position with all cables and conductors installed.
3. Contain a modem support fixture that allows the removal of the modem without tools or without removing the bracket from its attachment to the cabinet frame.
4. Be vertically mountable on a 19-inch standard rack rail using two machine screws and two wing nuts.

86-2.08B(3) Communication Cables

Provide the RJ45 Cat 6 ethernet patch cable with minimum length of 6 feet and the C2 cable which interfaces the controller's C2 connector and the LTE modem including all conductors and connectors required for that purpose. The LTE modem connector must comply with EIA-232 standard using a 9-pin Type D connector. Controller end connector for the Department-furnished Model 170E/2070L must comply with AMP 201360-2 or equivalent. All pins in both connectors must be gold plated. The cable must be at least 3 feet long. The cable wiring must comply with the following:

DB9M (to external modem)		C2P (to Model 2070L controller)	
Function (DB9M)	Pin	Pin	Function (C2P)
Transmit Data	3	K	Data In
Receive Data	2	L	Data Out
Signal Ground	5	N	Ground
Request to Send	7	J	Request to send
Clear to Send	8	M	Clear to Send
Data Terminal Ready	4	H	Clear Detect

86-2.08B(4) Antenna

LTE modem must have SMA external antenna connectors-male (plug) type and SMA antenna connectors-female (socket) type.

SMA antennas must support 1 dBi (LTE) gain and 2 dBi (cellular PCS) gain with a single or multi antenna configuration. Indoor type of SMA antenna is to be installed.

86-2.08C Construction

Install the modem under the manufacturer's instructions.

You may adjust the modem installation for field conditions if authorized by the Engineer.

86-2.08D Payment

Not used.

Replace "Reserved" in section 86-2.09 of the RSS for section 86 with:

86-2.09 VIDEO IMAGE VEHICLE DETECTION SYSTEM

86-2.09A General

86-2.09A(1) Summary

Section 86-2.09 includes installing video image vehicle detection system (VIVDS) for traffic signals.

86-2.09A(2) Definitions

Video Detection Unit (VDU): Processor unit that converts the video image from the camera and provides vehicle detection in defined zones. Unit includes an image processor, extension module, and communication card.

Video Image Sensor Assembly (VIS): An enclosed and environmentally-protected camera assembly used to collect the video image.

Video Image Vehicle Detection System (VIVDS): A system that detects video images of vehicles in defined zones and provides video output.

86-2.09A(3) Submittals

Submit documentation within 30 days after Contract approval but before installing VIVDS equipment.

The documentation submittal must include:

1. Certificate of Compliance: As specified in Section 6-3.05E, "Certificates of Compliance," of the Standard Specifications.
2. Site Analysis Report: Written analysis for each detection site, recommending the optimum video image sensor assembly placement approved by the manufacturer.
3. Lane Configuration: Shop drawing showing:
   - 3.1. Detection zone setback
   - 3.2. Detection zone size
   - 3.3. Camera elevation
   - 3.4. Selected lens viewing angle
   - 3.5. Illustration of detection zone mapping to reporting contact output
   - 3.6. Illustration of output connector pin or wire terminal for lane assignment.
4. Configuration Record: Windows PC compatible CD containing:
   - 4.1. Proposed zone designs
   - 4.2. Calibration settings
5. Mounting and Wiring Information: Manufacturer approved wiring video cable and service connection diagrams.
6. Communication Protocol: Industry standard available in public domain. Document defining:
   - 6.1. Message structure organization
   - 6.2. Data packet length
   - 6.3. Message usability
   - 6.4. Necessary information to operate a system from a remote windows based personal computer.
7. Programming Software: CD containing set up and calibration software that observes and detects the vehicular traffic, including bicycles, motorcycles, and sub-compact cars, with overlay of detection zones and allows adjustment of the detection sensitivity for a traffic signal application.
8. Detector Performance DVD Recordings and Analysis: Performance analysis based on 24-hour DVD recording of contiguous activity for each approach. Include:
   - 8.1. Two contiguous hours of sunny condition, with visible shadows projected a minimum of 6 feet into the adjacent lanes
   - 8.2. Two 1-hour night periods with vehicle headlights present.
9. Preventative Maintenance Parts Documentation: List of equipment replacement parts for preventative maintenance, including:
   - 9.1. Electrical parts, wiring and video cable
   - 9.2. Mechanical parts
   - 9.3. Assemblies.

Allow 7 days for the Engineer to review the documentation submittal.

If the Engineer requires revisions, submit a revised submittal within 5 days of receipt of the Engineer's comments and allow 5 days for the Engineer to review. If agreed to by the Engineer, revisions may be included as attachments in the resubmittal. The Engineer may conditionally approve, in writing, resubmittals that include revisions submitted as attachments, in order to allow construction activities to proceed.

Upon the Engineer's approval of the resubmittal, submit copies of the final documents (with approved revisions incorporated) to the Engineer.

Submit an acceptance testing schedule for approval 15 days before starting acceptance testing.

When beginning acceptance testing of VIVDS and detector performance and analysis, submit approved copies of the following:

1. Configuration Record: Windows PC compatible CD containing:
   1.1. Final zone designs
   1.2. Calibration settings to allow reinstallation.
2. Mounting and Wiring Information: Final wiring and service connection diagrams.
   2.1. One copy for the Engineer
   2.2. A second copy wrapped in clear self-adhesive plastic, be placed in a heavy duty plastic envelope, and secured to the inside of the cabinet door.

86-2.09A(4) Quality Control and Assurance

86-2.09A(4)(a) General

VIVDS and support equipment required for acceptance testing must be new and as specified in the manufacturer's recommendations. Date of manufacture, as shown by date codes or serial numbers of electronic circuit assemblies, must not be older than 12 months from the scheduled installation start date. Material substitutions must not deviate from the material list approved by the Engineer.

86-2.09A(4)(b) Training

You must provide a minimum of 16 hours of training by a factory authorized representative for a maximum of _8_ Department employees. Submit training material to the Engineer for approval at least 30 days before the proposed training. Training material content must include instructions for aligning, programming, adjusting, calibrating, and maintaining VIVDS. You must provide all materials and equipment for the training. Notify the Engineer 20 days in advance of the proposed training to obtain approval of place and time of the training. If agreement cannot be reached, the Engineer will determine the time and place.

86-2.09A(4)(c) Warranty

Furnish a 3-year replacement warranty from the manufacturer of VIS and VDU against defects in materials and workmanship or failures. The effective date of the warranty is the date of acceptance of the installation. Submit all warranty documentation before installation.

Replacement VIS and VDU must be furnished within 10 days of receipt of a failed unit. The Department does not pay for replacement.

Deliver replacement VIS and VDU to Caltrans Maintenance Electrical Shop at:

District 8 - Caltrans Electrical Maintenance Yard
175 West Cluster Street
San Bernardino, CA 92408

86-2.09B Materials

86-2.09B(1) General

VIVDS must include necessary firmware, hardware, and software for designing the detection patterns or zones at the intersection or approach. Detection zones must be created with a graphic user interface designed to allow to anyone trained in VIVDS system setup to configure and calibrate a lane in less than 15 minutes.

System elements must comply with the manufacturer's recommendations and be designed to operate continuously in an outdoor environment.

All equipment, cables, and hardware must be part of an engineered system that is designed by the manufacturer to fully interoperate with all other system components. Mounting assemblies must be corrosion resistant. Connectors installed outside the cabinets and enclosures must be corrosion resistant, weather proof, and watertight. Exposed cables must be sunlight and weather resistant.

86-2.09B(1)(a) Physical and Mechanical Requirements

VIVDS must include:

1. VIS and mounting hardware. Use a clamping device as mounting hardware on a pole or mast-arm.
2. VDU
3. Power supply
4. Surge suppression
5. Cables
6. Connectors
7. Wiring for connecting to the Department-furnished Model 332L traffic controller cabinet.
8. Communication card with multi-display port
9. Flat panel video display
10. DIN Rail mounted AC power assembly that includes a minimum of one convenience receptacle, four camera chassis ground connections, four camera AC neutral (AC-) connections, four 2 amp camera circuit breakers for hot (AC+) connections, and one AC source connection for Line, Neutral and Ground wires.
11. DIN Rail video surge suppression protection assembly that can accommodate up to six surge suppression modules

86-2.09B(1)(b) Electrical

VIVDS must operate between 90 to 135 V(ac) service as specified in NEMA TS-1. VIS, excluding the heater circuit, must draw less than 10 W of power. Power supply or transformer for the VIVDS must meet the following minimum requirements:

Minimum Requirements for Power Supply and Transformers

Item	Power Supply	Transformer
Power Cord	Standard 120 V(ac), 3 prong cord, 3 feet minimum length (may be added by Contractor)	Standard 120 V(ac), 3 prong cord, 3 feet minimum length (may be added by Contractor)
Type	Switching mode type	Class 2
Rated Power	Two times (2x) full system load	Two times (2x) full system load
Operating Temperature	From -37 to 74 °C	From -37 to 74 °C
Operating Humidity Range	From 5 to 95 percent	From 5 to 95 percent
Input Voltage	From 90 to 135 V(ac)	From 90 to 135 V(ac)
Input Frequency	60 ± 3 Hz	60 ± 3 Hz
Inrush Current	Cold start, 25 A Max. at 115 V(ac)	N/A
Output Voltage	As required by VIVDS	As required by VIVDS
Overload Protection	From 105 to 150 percent in output pulsing mode	Power limited at >150 percent
Over Voltage Protection	From 115 to 135 percent of rated output voltage	N/A
Setup, Rise, Hold Up	800ms, 50ms,15ms at 115 V(ac)	N/A
Withstand Voltage	I/P-0/P:3kV, I/P-FG:1.5kV, for 60 s.	I/P-0/P:3kV, I/P-FG:1.5kV, for 60 s
Working Temperature	Not to exceed 70°C at 30 percent load	Not to exceed 70 °C at 30 percent load
Safety Standards	UL 1012, UL 60950	UL 1585

Field terminated circuits must include transient protection as specified in IEEE Standard 587-1980, Category C. Video connections must be isolated from ground.

86-2.09B(1)(c) Technical Requirements

Camera and zoom lens assembly must be housed in an environmentally sealed enclosure that complies with NEMA 4 standards. Enclosure must be watertight and protected from dust. Enclosure must include a thermostat controlled heater to prevent condensation and to ensure proper lens operation at low temperatures. Adjustable sun shield that diverts water from the camera's field of view must be included. Connectors, cables and wiring must be enclosed and protected from weather. A gas tight (protected from dust and moisture ingress) connector must be used at the rear plate of the housing. Wiring to the connector must be sealed with silicone or potting compound.

Each camera and its mounting hardware must be less than 10 pounds and less than 1 square foot equivalent pressure area. Only one camera must be mounted on a traffic signal or luminaire arm. Top of camera must not be more than 12 inches above top of luminaire arm or 30 inches above top of traffic signal arm.

VIS must use a charge-coupled device (CCD) element, support National Television Standards Committee (NTSC) and RS170 video output formats, and have a horizontal resolution of at least 360 lines. VIS must include an auto gain control (AGC) circuit, have a minimum sensitivity to scene luminance from 0.01 to 930 foot-candle, and produce a usable video image of vehicular traffic under all roadway lighting conditions regardless of the time of day. VIS must have a motorized lens with variable focus and zoom control with an aperture of f/1.4 or better. Focal length must allow ± 50 percent adjustment of the viewed detection scene.

A flat panel video display with a minimum 17-inch screen and that supports NTSC video output must be enclosed in the Model 332L cabinet for viewing video detector images and for performing diagnostic testing. Display must be viewable in direct sunlight. Each VIVDS must have video system connections that support the NTSC video output format, can be seen in each camera's field of view, and has a program to allow the user to switch to any video signal at an intersection. A metal shelf or pull-out document tray with metal top capable of supporting the VDU and monitor must be furnished and placed on an EIA 19 inch rack with 10-32 "Universal Spacing" threaded holes in the Model 332L cabinet. System must allow independent viewing of a scene while video recording other scenes without interfering with the operation of the system's output.

Mounting hardware must be powder-coated aluminum, stainless steel, or treated to withstand 250 hours of salt fog exposure as specified in ASTM B 117 without any visible corrosion damage.

VDU must operate between –37 to +74 °C and from 0 to 95 percent relative humidity.

VDU front panel must have indicators for power, communication, presence of video input for each VIS, and a real time detector output operation. Hardware or software test switch must be included to allow the user to place either a constant or momentary call for each approach. Indicators must be visible in daylight from 5 feet away.

VDU must have a serial communication port, EIA 232/USB 2.0 that supports sensor unit setup, diagnostics, and operation from a local PC compatible laptop with Windows XP or later version operating system. VIVDS must have an Ethernet communication environment, including Ethernet communication card. VIVDS must include central and field software to support remote real-time viewing and diagnostics for operational capabilities through wide area network (WAN).

VDU, image processors, extension modules, and video output assemblies must be inserted into the controller input file slots using the edge connector to obtain limited 24 V(dc) power and to provide contact closure outputs. Cabling the output file to a "D" connector on the front of the VDU is acceptable. No rewiring to the standard Model 332L cabinet is allowed. Controller cabinet resident modules must comply with the requirements in Chapter 1 and Sections 5.2.8, 5.2.8.1, 5.2.8.2, 5.4.1, 5.4.5, 5.5.1, 5.5.5, and 5.5.6 of TEES.

86-2.09B(1)(d) Functional Requirements

VIVDS must support normal operation of existing detection zones while a zone is being added or modified. Zone must flash or change color on a viewing monitor when vehicular traffic is detected. Length and width of each detection zone for each lane must be approved by the Engineer.

Software and firmware must detect vehicular traffic presence, provide vehicle counts, set up detection zones, test VIVDS performance, and allow video scene and system operation viewing from the local traffic management center/office. VIVDS must support a minimum of 2 separate detection patterns or zones that can be enacted by a remote operator at the signal controller cabinet.

VIVDS detection zone must detect vehicles by providing an output for presence and pulse. At least one detection output must be provided for each detection zone. One spare detection output must be provided for each approach. Detection performance must be achieved for each detection zone with a maximum of 8 user-defined zones for every camera's field of view.

VIVDS must detect the presence of vehicles under all types of adverse weather and environmental conditions, including snow, hail, fog, dirt, dust or contaminant buildup on the lens or faceplate, minor camera motion due to winds, and vibration. Under low visibility conditions, the VIVDS must respond by selecting a fail-safe default pattern, placing a constant call mode for all approaches. VIVDS outputs must assume a fail-safe "on" or "call" pattern for presence detection if video signal or power is not available and must recover from a power failure by restoring normal operations within 3 minutes without manual intervention. If powered off for more than 90 days, system must maintain the configuration and calibration information in memory.

Detection algorithm must be designed to accommodate naturally occurring lighting and environment changes, specifically the slow moving shadows cast by buildings, trees, and other objects. These changes must not result in a false detection or mask a true detection. VIVDS must not require manual interventions for day-night transition or for reflections from poles, vehicles or pavement during rain and weather changes. VIVDS must suppress blooming effects from vehicle headlights and bright objects at night.

Vehicle detection must call service to a phase only if a demand exists and extend green service to the phase until the demand is taken care of or until the flow rates have reduced to levels for phase termination. VIVDS must detect the presence of vehicular traffic at the detection zone positions and provide the call contact outputs to the Model 170E or Model 2070L controller assembly with the following performance:

Detector Performance

Requirements	Performance during AMBER and RED interval	Performance during GREEN interval
Average response time after vehicle enters 3 feet into detection zone or after exiting 3 feet past detection zone	≤ 1 s	≤ 100 ms
Maximum number of MISSED CALLS in 24-hour duration, where MISSED CALLS are greater than 5 s during AMBER and RED intervals and greater than 1 s during GREEN intervals (upon entering 3 feet of detection zone or after exiting 3 feet past detection zone).	0	10
Maximum number of FALSE CALLS in 24-hour duration (calls greater than 500ms without a vehicle present)	20	20

VIVDS must be able to locally store, for each lane, vehicle count data in 5, 15, 30, and 60 minute intervals for a minimum period of 7 days and be remotely retrievable. VIVDS must count vehicular traffic in detection zone with a 95 percent accuracy or better for every hour counted over a morning or an evening peak hour. VIVDS detection zone tested must have a minimum range of 50 feet behind the limit line for each approach. Testing period will be pre-approved by the Engineer 48 hours in advance.

86-2.09C Construction

Install VDU in a Department-furnished Model 170E or Model 2070 controller assembly. Install VIS power supply or transformer on a standard DIN rail using standard mounting hardware and power conductors wired to DIN rail mounted terminal blocks in the controller cabinet. Each VIS must be connected to an individual circuit breaker in the DIN Rail mounted power assembly.

Wiring must be routed through end caps or existing holes and sealed. New holes for mounting or wiring must be shop-drilled.

Wire each VIS to the controller cabinet with a wiring harness that includes all power, control wiring, and coaxial video cable. Attach harness with standard MIL type and rated plugs. Cable type, connectors and wire characteristics must comply with manufacturer's recommendations for the VIS to cabinet distance. Wiring and cables must be continuous, without splices, between the VIS and controller cabinet. Coil a minimum of 7 feet of slack in the bottom of the controller cabinet. For setup and diagnostic access, terminate serial data communication output conductors at TB-0 and continue for a minimum of 10 feet to a DB9F connector. Tape ends of unused and spare conductors to prevent accidental contact to other circuits.

Label conductors inside the cabinet for the functions depicted the approved detailed diagrams. Label cables with permanent cable labels at each end.

Adjust the lens to view 110 percent of the largest detection area dimension. Zones or elements must be logically combined into reporting contact outputs that are equivalent to the detection loops and with the detection accuracy required.

Verify the performance of each unit, individually, and submit the recorded average and necessary material at the conclusion of the performance test. Determine and document the accuracy of each unit, individually, so that each unit may be approved or rejected separately. Failure to submit necessary material at the conclusion of testing invalidates the test. The recorded media serves as acceptance evidence and must not be used for calibration. Calibration must have been completed before testing and verification.

Verify the detection accuracy by observing the VIVDS performance and recorded video images for a contiguous 24-hour period. The recorded video images must show the viewed detection scene, the detector call operation, the signal phase status for each approach, the vehicular traffic count, and time-stamp to 1/100 of a second, all overlaid on the recorded video. Transfer the 24-hour analysis to DVD.

VIVDS must meet the detection acceptance criterion specified in table titled "Detector Performance."

Calculate the VIVDS's vehicular traffic count accuracy as 100[1-(|TC-DC|/TC)], where DC is the detector's vehicular traffic count and TC is the observed media-recorded vehicular traffic count and where the resulting fraction is expressed as an absolute value.

The Engineer will review the data findings and accept or reject the results within 7 days. Vehicle anomalies or unusual occurrences will be decided by the Engineer. Data or counts not agreed by the Engineer will be considered errors and count against the unit's calibration. If the Engineer determines that the VIVDS does not meet the performance requirements, you must re-calibrate and retest the unit, and resubmit new test data within 7 days. After 3 failed attempts, you must replace the VIVDS with a new unit.

Notify the Engineer 20 days before the unit is ready for acceptance testing. Acceptance testing must be scheduled to be completed before the end of a normal work shift. You must demonstrate that all VIS and VDUs satisfy the functional requirements.

86-5.04C Construction

Not Used

86-5.05D Payment

Not Used

DIVISION X MATERIALS

Add to section 90-2.02B:

You may use rice hull ash as an SCM. Rice hull ash must comply with AASHTO M 321 and the chemical and physical requirements shown in the following tables:

Chemical property	Requirement (percent)
Silicon dioxide (SiO_2)[a]	90 min
Loss on ignition	5.0 max
Total alkalies as Na_2O equivalent	3.0 max

Physical property	Requirement
Particle size distribution Less than 45 microns Less than 10 microns	 95 percent 50 percent
Strength activity index with portland cement[b] 7 days 28 days	 95 percent (min percent of control) 110 percent (min percent of control)
Expansion at 16 days when testing project materials under ASTM C 1567[c]	0.10 percent max
Surface area when testing by nitrogen adsorption under ASTM D 5604	40.0 m^2/g min

[a]SiO_2 in crystalline form must not exceed 1.0 percent.
[b]When tested under AASHTO M 307 for strength activity testing of silica fume.
[c]In the test mix, Type II or V portland cement must be replaced with at least 12 percent rice hull ash by weight.

For the purpose of calculating the equations for the cementitious material specifications, consider rice hull ash to be represented by the variable *UF*.